

Superhydrophobic cotton to clean marine oil spill

September 23, 2021

In news- Researchers at the IIT, Guwahati, have developed a new class of super-hydrophobic cotton composite with Metal-Organic Framework (MOF) that promises marine oil-spill clean-up in near future.

About super-hydrophobic cotton-

- It is a **highly porous and water-repellent super-hydrophobic cotton composite material containing MOF.**
- It can **absorb oil selectively from an oil-water mixture.**
- The MOF composite has great **capability for selective separation of the oils from oil / water mixtures** and the separation efficiency lies between 95 per cent and 98 per cent, irrespective of the chemical composition and density of the oils.
- Besides, the **MOF composite is also able to absorb large volumes of oils and can be reused for a minimum of 10 times** so that the sorbents can provide more recovery of the spilled oil.
- **Both heavy and light oils can be effectively absorbed by the material,** which is easy to prepare, cost-effective and recyclable
- Its goal was to develop a new material which could be synthesised easily and should be cost-effective.
- The **researchers have grown a new MOF material on the surface of medical cotton, which is environmentally friendly and cost effective.**
- Such low-cost material will reduce the production cost of the material for large-scale synthesis for real applications, compared to currently available materials.
- The team initially developed a super-hydrophobic MOF

which can repel the water and float on the water surface. Then, they grew the same MOF on the surface of medical cotton.

- It was observed that the **medical cotton changes from hydrophilic to super-hydrophobic material** and can float on the water surface.
- **The MOF-coated cotton fibre composite showed water repellency** with a water contact angle of 163° .
- The flexible super-hydrophobic MOF composite showed an oil absorption capacity of more than 2500 wt per cent.
- Motor oil, kerosene and gasoline were used by the team in this study to investigate the real-life potential of the material for oil-spill clean-up.
- **The research team has also demonstrated the separation of oil from oil / water mixture by simple gravity-directed filtration** and also a collection of underwater oil against gravity.

What are Metal-Organic Frameworks (MOFs)?

MOFs are a class of compounds containing metal ions coordinated to organic ligands to form 3D structures, with the special feature that they are often **highly porous materials that act like a sponge**.

What is Oil spill?

An oil spill is the release of a liquid petroleum hydrocarbon into the environment, especially the marine ecosystem, due to human activity, and is a form of pollution. The term is usually given to marine oil spills, where oil is released into the ocean or coastal waters, but spills may also occur on land.

International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)-

- It is an international maritime convention establishing measures for dealing with marine oil pollution incidents

nationally and in cooperation with other countries.

- As of November 2018, there are 112 state parties to the convention.
- The OPRC Convention was drafted within the framework of the International Maritime Organization (IMO) and adopted in 1990 entering into force in 1995.
- In 2000 a Protocol to the Convention relating to hazardous and noxious substances (HNS) was adopted (the OPRC-HNS Protocol).
- In accordance with this Convention and its Annex, States-Parties to the 1990 Convention undertake, individually or jointly, to take all appropriate measures to prepare for and respond to oil pollution incidents.

The practical applications of this research include Cleaning the spilled oil from environmental water (river, sea or ocean water) during oil transportation with high efficiency and large absorption capacity, thus reducing environmental water pollution.